

### SPAWNING CONTROL OF THE JAPANESE SPINY LOBSTER

The Japanese spiny lobster, *Panulirus japonicus*, is a very important crustacean in Japan. In this study, the nature of their breeding was investigated as a basis for potential aquaculture of this species. The normal breeding season around Izu Peninsula, Japan, is from June to August. Incubation period was variable and temperature dependent. At normal water temperature on Izu Peninsula in 1989, the incubation period was two months. Phyllosoma larvae were seen toward the beginning of August.

Lobsters were maintained in running sea water aquaria, 142 x 142 x 84 cm, with a capacity of 1,000 L and were fed short-necked clams or fish. Body weight and carapace length of lobsters were 70–440 g and 39–80 mm in females, and 65–450 g and 41–80 mm in males. Beginning in 1983, animals were held at normal, ambient water temperatures or at constant temperatures of 20°C and 25°C.

Paired mature lobsters were transferred to small glass aquaria for observations of copulation and spawning. The mature female lobster grooms the pleopods with the 11th leg before copulation. Body weight and carapace length of lobsters in copulation were 125–310 g and 52–70 mm in females, and 210–360 g and 59–75 mm in males. Males were larger than females among copulating pairs.

Copulation and spawning were observed early in June. Copulation generally occurred at night to early morning. The pre-copulatory phase of the courtship lasted 0.5–3 hours. In

copulation, the male embraced the female, belly to belly, for about 20 seconds. With a vigorous extension of the male's abdomen, spermatophores were discharged and deposited on the female's sternum and were stored externally. Frequency of copulation was between one and four times at night.

Within 10–130 minutes after final copulation, spawning, or oviposition began. During oviposition, the female lobster usually assumes a vertical position that will guarantee passage of the eggs from the oviduct opening to the ventral side of the abdomen where the eggs are cemented to the pleopods. Oviposition required 30–50 minutes. Thirty to 550 thousand eggs were deposited. Egg size was about 0.5 mm in diameter. In lobsters held at 20°C and 25°C in the laboratory, spawning was observed in March and April, 1.5–2 months before the start of normal spawning season and spawns in animals held at normal water temperatures. The eggs hatched early in May and June.

Our observations suggest that spawning of the Japanese spiny lobster can be controlled by changes in the water temperature of the rearing aquaria. This may be of great significance in the potential aquaculture of this species.

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### EXPERIMENTAL CARAPACE INCREASE IN THE LOBSTER ( *HOMARUS AMERICANUS*) FISHERY ON CAPE BRETON ISLAND, CANADA

The Gulf of St. Lawrence lobster population has historically been very productive, landing half of the landed weight of lobsters in Atlantic Canada. While the fishery has experienced fluctuations over the last hundred years, landings in the past fourteen years have steadily increased with the exception of areas in central Northumberland Strait. The Gulf of St. Lawrence lobster fishery captures 75% of lobsters at the commercial 'canner' size (63.5 to 80.9 mm) and 25% at the commercial 'market' size (81.0 mm and greater).

The lobster population of the southern Gulf of St. Lawrence experiences a wide seasonal range of temperature, a range of 0°–20°C is possible at a depth of 10 metres. Under these conditions, some lobsters moult twice a year. Female lobsters become functionally mature at a smaller size (77–80 mm) than in other areas on the Atlantic coast. Recent studies on fecundity have shown that Gulf lobsters carry more eggs at a given size than lobsters from other regions.

In 1987 we promoted an experimental legal carapace size increase programme on the west coast of Cape Breton Island. The purpose was to determine experimentally whether an increase in minimal legal size would enhance yield as predicted by the current models. Over four years the legal carapace size was raised by steps of 1/16" from 2 1/2" to 2 3/4" (63.5 to 70.0 mm). The final increment was

completed in 1990. During the carapace size increase programme the size frequency distributions of lobsters caught in the commercial fishery were monitored in the area and in adjacent control areas. Lobster tagging programmes were completed in 1984 and 1988 in the experimental zone to determine if any changes in movement or growth would occur.

To date, the size frequency distributions show only a slight increase in percent frequency for lobsters released during the first three years of the project and presently reaching the new legal size. The experiment will be pursued over a period of five years in order to contrast benefits, if any, of the minimal size increase in the experimental area with the control areas. At this point in time it is not possible to identify any benefits resulting from the carapace size increase despite the model predictions. Landings increased considerably more in one control area than in the experimental area. The tag returns to date do not show significant differences in the growth or movement patterns as seen before the carapace increase programme. It presently appears very difficult to distinguish any changes generated by the minimal size increase from changes generated by natural environmental causes. These results are similar to those encountered by meteorologists confronting predictive modeling and chaos.

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